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Abstract: Academics are by far more responsive to social, economic and technological changes and therefore academic identity must be resilient and flexible in order to fully engage with diverse and numerous purposes of academic institutions. Considering the fierce competition in the UK higher education sector, the demand for an academic curriculum to be globally relevant is greater than ever. In this paper, new challenges within the British higher education setting in globally competitive environment are discusses. The railway engineering curriculum within civil engineering program at the University of Birmingham (accredited by the Institution of Civil Engineers, U.K.) is critically reviewed and evaluated, aiming at enhancing core technical skills alongside those required for systems thinking solutions. Comparative evaluations considering learning outcomes and industry expectation are carried out. Based on the review and evaluation using both academic and industry insights, some insights and recommendations to improve student experience and to enhance learning environment with the emphasis on employability, systems thinking approach and industry practice are highlighted.

Keywords: railway engineering education; student experience; employability; systems thinking; research-led teaching

Subject classification codes: Engineering Education

Introduction and Contemporary Teaching Pedagogies

Academic identity can be at risk if its scope and purpose is narrowly defined (Henkel, 2005; Gardner and Willey, 2018). The academic identity in this case implies the multi-tasks and purposes of each academic member serving students, the institution and communities. This insight resonates with the common thought about globally competitive academic practice. Prior to the academic role, the author had spent over 14 years in rail industry toward a technical specialist (senior project manager rank) in a governmental rail authority. The combined academic and industry experience self-exhibits that academics are by far more responsive to social, economic and technological changes and therefore academic identity must be resilient and flexible in order to fully engage with diverse and numerous purposes of academic institutions exposed to uncertain societal needs (Kogan, 2002; Winter, 2009). The author found that industry experience can provide significant insight and values in positioning the students' learning experience and building their competency towards industry-ready graduates. Such the values can improve employability-based curriculum, which indeed expands industry-ready skills expected by the industry and enhance job opportunity for engineering students (The Joint Board of Moderators, 2015). The importance of employability including systems-thinking and teamwork is also evident by its presence as the key component in any university ranking around the world (Gallego-Schmid et al, 2018; Lewis and Geertshuis, 2018) and it is one of the key values the author passion for and will be focused on later for the curriculum review. This paper will highlight the importance of interdisciplinary teaching to produce systems-thinking and multi-faceted team approaches to sustainable rail engineering solutions. Methods for measuring success in education are often not fit for purpose, producing good students but probably poor engineers. Real-life failures to apply systems thinking presents a serious, difficult to detect, and often ultimately economically-environmentally negative situation. In this paper, the author recognised the problems from traditional rail education and presented some techniques to embrace systems thinking, with the aim at enhancing core technical skills alongside those required for systems thinking solutions. This provides both unique opportunities and novel challenges for railway engineering education in the UK.

By engaging with educational sectors such as universities, high schools, charitable associations, authorities and STEM (Sciences, Technology, Engineering and Mathematics) projects, academics can embrace practicality and systemic thinking approach to teaching and learning experience for students (V3 & V4, UK Professional Standards Framework, 2011). Using industry based projects and placements can also motivate students to take a more active role in strategically managing their own learning development (self-based curiosity) as an ongoing passion in order to build and continuously improve complex socio-technical systems in the real world (Burdett and Baker, 2017; Burns and Chopra, 2017). Such practice can considerably encourage students to develop life-long learning ability and to engage in industry placements and networking. It is well known that coursework (i.e. groupwork, project-based learning) should embed key important aspects stimulating life-long learning (Knapper and Cropley, 2000; Palmer, 2002); industry projects and case studies for project-based and enquiry-based learning (Mills and Treagust, 2003; Savin-Baden, 2006; Deignan, 2009); and professional competency (e.g. computer-aided design, railway terminologies, technical standards and systems requirements, specialised techniques, European technical standards for interoperability, etc.), especially in railway industry sector. In particular, lifelong learning is very important in practice as rail technologies and best-practice standards change regularly. In reality, a railway project is very complex and multi-disciplinary so industry case studies and professionalisms are important for students to build meta-competency and knowledge that is practical and employable (Briginshaw, 2012). Systems thinking approach and intrinsic motivation for lifelong learning are thus very crucial skills needed to be embedded in the university teaching and learning. This should thus be any academic's commitment to the professional values demonstrated in Descriptor V2 of the UK Professional Standards Framework for Teaching and Supporting Learning in Higher Education (2011). In a class, academics in research-intensive universities are required to adopt some new insights from research and disseminate the new findings and the important values of research innovation through class teaching, seminars, and conferences (V3, UK Professional Standards Framework, 2011). Therefore, the academic's engagement in research provides significant practical values to academic practice where new bodies of knowledge are often generated through research and development. Such the industrial and research values can stimulate students' curiosity and motivation in order to self-learn and self-develop their employable hands-on experience. Its value chain of intrinsic motivation also uplifts the quality, premium and differentiation of teaching and learning for the next generation railway engineers (Firat et al., 2018). The industry case problems and research innovation could bring in industrial values and underpin student experience and systems thinking capability in railway research and education at the university. For example, the design of new highspeed rail line in the UK (or HS2 Project) from London to Birmingham was used in class at the University of Birmingham to assure these experiences. Industry guest speakers from HS2 and Japan Railways were invited to the class to offer systems thinking insights and motivate students for deeper learning into the subject.

The value of community engagement and systems thinking approach can enhance students' professional development (Jacobs et al., 2015; Kaewunruen et al., 2016). The system thinking approach supports the value that allows students to think critically and coherently throughout multi- and trans- disciplines. This value is extremely critical in order to successfully work in a very complex and highly interdisciplinary project, such as those in railway industry. Using academic's research consulting can provide students' insight into practical solutions to help improve business growth and governmental policy in reality (Zirkel, 2002; Malcolm and Zukas, 2009). The collective values through actual practices in the industry and academic research identity motivate the author to review and evaluate the railway curriculum in order to enhance employability and systems thinking approach via industry project-based learning (Mills and Treagust, 2003). This paper will highlight the outcome of module and curriculum reviews and recommendations enabling meta graduate attributes for the next generation of railway engineers. The comparative review of railway engineering curriculum has been conducted, aiming to provide evidence-based analysis into the teaching and learning pedagogies and tactics that enhance learners' systems thinking capability.

Railway Engineering Curriculum

The BEng/MEng Civil and Railway Engineering degree[1] has been accredited by a joint professional body with expectations from the engineering council (The Joint Board of Moderators, 2015; Engineering Council, 2016). With respect to railway engineering branch, the author have also led a module (a module is the 20-credit subject spanning over 1 full year – commonly found in UK universities): Year 2 Railway Infrastructure Engineering and have participated in teaching of another module (Year 1 Introduction to Railway Engineering), in addition to final year theses and advanced projects (Years 3 and 4). This curriculum review is based on key pedagogic research and scholarships theories and conceptual frameworks, as discussed earlier, focussing on the key aspects associated with the involvement in teaching and learning such as the importance of improving *quality* (competency and attitudes), independent learning, enquiry-based learning using industry case studies, deeper and life-long learning and employability skills (Eyler, 2009). These findings resonate with the author's academic identity and the key values the author could bring in to improve the railway curriculum. Understanding how to integrate these attributes in railway courses will be the main goal of this study.

Integration of enquiry-based and problem-based learning practices has been adopted and embedded in the module content delivery and student activities, which embrace the teaching vision of the University (University of Birmingham, 2009; McLinden and Edwards, 2011). Based on the review of Railway Infrastructure Engineering Module, the group design

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[1] http://www.birmingham.ac.uk/undergraduate/courses/civil-engineering/civil-engineering-railway-meng.aspx

coursework has been designed to enable students becoming a thinker and them contributing to enquiry-based learning of design concepts, requirements and impacts using a contemporary industrial design case. The students in this module (Year 2 cohort of students at around 20-21 years old, 20% female: 80% male) have been randomly arranged in groups so that they have opportunity to work with someone they do not know and learn to effectively communicate with others. This skill is found to be vital for students in order to develop robust employability skills (Tryggvason and Apelian, 2012). The impact of the employability enhancement cannot be underestimated. Such the related activities often inspire and embed passion for railway professional career path to students (Vest, 2011). This can help the academics (with railway engineering background and industry guest lecturers) to deliver lectures more effectively as students would be very interested in classes.

Table 1 compares the top engineering employability skills required by employers in Asia and in the UK. It is important to note that problem-solving skill, communication, IT and computer, life-long learning and management skills dominate across the continents. The author's own industry experience also found that the *problem-solving, systems thinking and life-long learning skills* are very critical employability attributes to become a specialised engineer or practitioner (Conner et al., 2000). These critical attributes can actually be developed and enhanced in classes through the right integration mix of case studies (using real-life problems), collaborative learning (interdisciplinary teamwork and group presentations), design simulations (using an advanced computing platform), and flipped classes (problem solving and problem-based learning). The combination of these activities (at the right workload for students) could be delivered to improve students' learning experience (Kahn and O'Rourke, 2004). It is also noted that the soft skills (such as interpersonal skill, communication and presentation skills, workplace skills) could not be further developed if the students are not firstly inspired to learn to work with each other and if the rational to develop such skills is not clearly articulated to them. These points are vital to the success of the integration (Yadav et al., 2010). The main role as the module leader is to facilitate such activities and supporting environment in which learning takes place, by providing industry-based group assignment, team member allocation, access to suitable resources, consultancy sessions where practical advice (based on my industry values) and formative feedback could be offered to students. This is with the intention to provide supportive and stimulating environments that such feedbacks are acted upon by students (Gibbs and Simpson, 2005).

Table1: Engineering employability skills required by employers, adopted from Kaewunruen (2016)

UK (Conner et al., 2000)	**Singapore** (Zaharim et al., 2006)	**Japan** (Zaharim et al., 2006)
- New and specific technical skills - Computer literacy and IT skills - Multi-skilling and greater flexibility -The ability to deal with change - An ability to continue learning, re-skilling - Communication skill - Team working and getting on with others, including being able to work in self-managed teams - problem-solving and diagnosis - 'whole system' thinking - organisation and management	- Workplace literacy and numeracy - IT and Technology - Problem solving - Initiative and enterprise - Communication and Relationship - Lifelong learning - Globalisation - Self-management - Workplace-related life skills - Health and workplace safety	- Communication skills - Problem solving - Goal-setting skill - Personal presentation skills - Visioning skills - IT and computer - Leadership - Self-assessment skills

Based on the critical literature review, it is important to note that the positive use of undergraduate research can boost high-impact student experience; and then students gain personal development and research skills, which could benefit their career path (Lappatto, 2010). The undergraduate research can also enhance academic practice related to teaching and learning in terms of inquiry-based learning (Bernold, 2007), independent learning (Thomas et al., 2015) and improve students' problem-solving skills (Grigg et al., 2004); and their overall positive experience that results in those students developing a passion for active learning (Prince, 2004) and intrinsic motivation for life-long learning (Kolb, 2015). This intrinsic research stimulation is very important for developing a capable and competent engineer as required by Engineering Council (2016). In fact, it is reported by Lappatto (2010) that engineering graduates who embarked on a research project could develop their analytical, problem-solving and independent lifelong learning skills at a higher level than those graduates who did not.

In Railway Infrastructure Engineering Module, a systems thinking approach has been introduced to students early on through the understanding of the interconnectedness between infrastructure components, stakeholders, risks and values. As such, the course materials together with group design guideline and considerations have been developed in order to underline the systems approach because railway is multidisciplinary and complex by nature. Through this methodology, the new module (e.g. Rail Infrastructure Engineering Module) embedded within the new BEng/MEng civil and railway curriculum can address some of the important aspects discussed above. Those activities will satisfy the need for students to "*(1) see the big picture, i.e., the connected view of the ideas that define the discipline; (2) integrate across courses rather than experience the curriculum as a set of discrete courses; and (3) come into contact with engineering faculty and new engineering ideas developed during the year of study*", which will equip them with systems thinking skill (Ambrose, 2013). The module arrangement also enables more flexibility for students to think outside the box (e.g. changes in track design; new ways of track components and design; adoption of opinions from other stakeholders such as governments, industry and academia). The success of embracing systems thinking approach in engineering education can be evident by the effectiveness in teaching and learning at MIT, Drexel and CMU (Ambrose, 2013). These attributes are the area for module and curriculum improvement for civil and railway engineering program, where a module leader can draw on from multi-disciplinary knowledge bodies and advanced research.

The lack of emotional connection or passion disconnected to the railway engineering career can also yield high attrition of first year engineering students. Based on an evaluation at

Stanford University, Sheppard and Jenison (1996) found that it is important to increase educational quality in their engineering design classes. Such quality includes competency and attitudes. “Competencies are the skills necessary to carry out the mechanics of a particular quality” while “Attitudes refer to the mental position or feeling an engineer has with regard to the importance of a quality in carrying out a job, and encompasses beliefs and buy-in.” (Sheppard and Jenison, 1996; Kaewunruen, 2017). Note that these attitudes are related to affective objective under the Bloom’s taxonomy of learning (cognitive). Without these attitudes (e.g. a loss of interest in science; believing that non-STEM majors hold more interest or offer better education; poor teaching by STEM faculty; feeling overwhelmed by the pace and the load of the curriculum demands, etc.), the researchers recognised significant attrition of the first year students in their engineering program. In light of these aspects, it is also found that the findings reflect a similar incident in the author’s class (Kaewunruen, 2016). After the first few weeks of Year 2’s Railway Infrastructure Engineering, the author observed some attrition in the module and some students (around 10% or 3 out of 33) withdrew from the class. At the particular time, the author was too focussed on delivering high-end, in-depth practical and technical content to the students in the class. With much of industry experience, the author was predominantly thinking that the course content depth level was not sufficient to get students a job and was then bombarding students with reading materials and highly expecting them to read them all before and after class. After a couple of weeks, a few of the students started to complain that certain content was too much and the class finished too late or occasionally over time (i.e. class runs between 55 – 70 minutes). One of the key aspects for effective teaching and learning practice learnt from this journey is that difficult learning experience associated with the pace and the workload of the module content could easily undermine the student attitudes. Overwhelmed feeling can cause bad student experience in class and can cause students a loss of interest of the subject and even perhaps a career in railway engineering. This had let the author to adapt and readjust the course content, the pace of delivery and the load of coursework in the following weeks. After such practice, students seemed to enjoy the class and had positive learning experience. During the finals, the group presentations for the outcome of student group design projects had impressively demonstrated students' professionalisms, engagement and enthusiasms in railway engineering knowledge and its applications to broader societies in order to regenerate economic, societal and environmental impacts.

Curriculum Review and Evaluation

In this paper, the emphasis is placed on BEng/MEng Civil and Railway engineering curriculum and the associated module the author lead within this program. The undergraduate programme in railway engineering, as shown below in Table 2, is considered as it is within the author's academic identify and industry experience values. It is well known that any engineering program is so public-safety critical that the engineers developed can practice safely over different stage of career path (Briginshaw, 2012). The aim is to evaluate whether employability and systems thinking attributes are fully promoted within the program, since they are the critical catalysts for the transformation from a good student to a capable engineer. Through the curriculum review by the author, the importance of key employability attributes will be considered for embedment in the UOB's BEng/MEng Civil and Railway Engineering Program, as elaborated in Table 2. The curriculum review shows that the research component is underlined in the program to enhance intrinsic motivation by using the third year's design projects and for the fourth year's research project.

Table 2: Course structure for BEng/MEng Civil and Railway Engineering at UOB

Theme	Year 1	Year 2	Optional Year Placement	Year 3	Optional Year Placement	Year 4 (MEng)
Civil	- Statics & Mech - Fluids - Materials - Design I	- Structural Eng I - Floods & Rivers - Geotech Eng I - Design II		- Structural Eng II - Geotech Eng II		- Structural Eng III - Geotech Eng III

	- Maths	- Management				
Electrical	- Microprocessor - Circuits I - Programming - Analysis - Group Project	- Digital Systems - Circuits II - Signal Systems - Control - Management		- Hardware Design - Control Systems - Power Eng & Traction		- Advanced Systems - Intel Systems.
Railway	- Introduction to Railway Systems	- Rail Infrastructure - Railway Traction		- Train Control - Railway Op & Management - Design projects		- Advanced topics in railway - Research Projects

The emphasis of this curriculum review is placed on the key employability attributes (systems thinking, problem-solving, and independent lifelong learning) and their relationship to coherences and the cross transfer of technical knowledge. The importance and significance of employability and intrinsic motivation (passion for career) was discussed earlier with supporting evidences. Based on the student learning outcomes of Railway Infrastructure Module, it can be observed that Year 2 students could not properly follow the course content. After reviewing the curriculum and modules' learning outcomes and course content, it was found that there exists incoherence of the technical knowledge from Year 1. Although the coursework has been developed from the industry demand and real case studies, the feedbacks of students (collected by the students' feedbacks to module delivery) revealed that it is important to establish the coherences and cross transfer of technical knowledge, in order to help students learn in class effectively. These issues are critical as they could undermine the learning experience and railway competency development of students. These are the key reasons that motivate this study (through the consultation with the University of Birmingham's Higher Education Futures Institute, HEFi) to emphasis those themes on this curriculum review and module discussions.

In light of the railway curriculum, it needs to serve dual functions: the former, to give students 'a good overall knowledge of how railways function as a whole and what their role is' (Briginshaw, 2012); and the later, to enable thorough critical engineering foundation knowledge, that results in a self-motivated and life-long learning (Kaewunruen et al., 2016). Although this curriculum has been accredited by JBM (the congregation of the Institution of Civil Engineers, Institution of Structural Engineers and the Chartered Institution of Highways and Transportation), there is no national or common undergraduate curriculum for railway engineering. This creates an opportunity for the School to develop novel teaching and learning approaches and new methods of delivery and assessment, which can lead to graduates achieving the learning outcomes considering a systems approach and the needs of industry and society (Ambrose, 2013; Stephens, 2013; Spencer and Mehler, 2013; The Joint Board of Moderators - JBM, 2015). For this curriculum review, the learning outcomes of railway modules were obtained from University website (School of Engineering, 2016). As the program is relatively new, the first cohort has recently completed Year 3 so this review has been based on desktop analysis of module learning outcomes, evaluation of module variety, coherence analysis and cross transfer of technical knowledge derived from associated courses. However, it is important to note that 100% of the first BEng cohort (3 years) has been offered a position in industry prior to the graduation. In this paper, this curriculum review was exercised using the author's industry experience and values derived from academic identity. Google searches for comparative degrees offered globally had also been conducted. It is found that NetworkRail (2016) has developed a 2-year foundation degree in railway engineering with Sheffield Hallam University (SHU).

As shown in Table 2, the first two years of the program at UOB aim to develop students' fundamental knowledge and core competency in civil engineering with additional fundamental modules in railway systems engineering, rail infrastructure and railway traction. These fundamental modules are common for all students in railway engineering degree program. In the third and fourth years, specific industrial modules will cover diverse topics and aspects of civil and railway engineering such as train control, operations, and project design.

Students are also able to develop tailored skill such as tracks, switches and crossings, operations, or electrification to position them for their individual specialisation through specific railway interests and research projects in their fourth year as part of enquiry based learning (Kahn and O'Rourke, 2004). It is important to note that most of railway modules build on and draw from the skills and knowledge developed through either civil or electrical engineering degree. To certain extent, some content in each module is based on the interdisciplinary knowledge established across those main-stream subjects in civil/electrical/mechanical engineering degrees. Students can optionally choose to spend an additional year in industry to earn experience and job opportunities, creating their own experiential learning (or learning by doing) that connects theory and practice in actual and authentic settings (Byers et al., 2013). On successful completion of an industry placement arranged by the School, they will also be awarded '*the Certificate of Industrial Studies to improve their employability prospect'* (School of Engineering, 2016).

Table 3 shows its course structure at SHU. This is the only available course in the UK and it could be considered comparable with the current course. Because the program opened in 2014, there is no firm data available until students start graduating in 2017/2018. As a result, the curriculum has been evaluated based on available content of the courses and previous pertinent literature in open platforms.

Table 3: Course structure for 2-year foundation degree in railway engineering at SHU

Theme	Year 1	Year 2
Track	- Maths and Engineering Science - Rail Specific Engineering - Business & Legislative Studies - Industry project	- Geotechnics and Drainage - Track Engineering - Track Engineering Standards - Project and Quality Management

Students at SHU may intersperse their work placements within the studies to embrace 'the pedagogies of engagement' when students will get real feedback from work peers (Smith et al., 2005). This program has similarity to UOB's first 2 years where the fundamental engineering principles will be emphasised. However, SHU program lacks of interdisciplinary knowledge that could have contributed to a systems thinking approach (Ambrose et al., 2010). Interconnected skills and knowledge derived from Civil/Electrical Engineering degree could not be fully established from these foundation years at SHU.

In contrast, UOB's program could result in students lacking of specific niche skills and in-depth knowledge (such as track tools, complex component assembly, advanced inspection and surveying tools, etc.). This can be observed from the fact that similar railway technical courses at the University of Illinois at Urbana Champaign in the US and at KTH Royal Institute of Technology in Sweden (note that there are only two universities outside the UK that could offer appropriate railway modules) are offered as the 4th year and graduate (5th year) modules, and certain prerequisite subjects have been set for each railway module (NURail, 2016). With this in mind, these counterparts could actually run the railway-related courses at a more technically profound level e.g. advanced design using CAD/CAM, advanced Finite Element Method, 3D printing, multi-scale analysis, advanced fracture mechanics, etc. (Remennikov and Kaewunruen, 2008; Setsobhonkul et al., 2017). Therefore, based on the curriculum review, it is recommended that the UOB program be adaptive and have flexibility to embed enquiry-based and problem-based learning activities in each module through collaborative learning tasks, real-world industry case studies, flipped classroom, field-based learning and design simulation technology in order engage students for deeper learning and ensure that they develop life-long learning skills (Heinrich et al., 2007; Jiusto and DiBiasio 2006; Raju and Sankar, 1999). These attributes could compensate the loss in niche skills as the students can actively learn further on the job. It is believed that this will strengthen the module by enabling students to get real flavour of systems thinking and multi-disciplinary nature of railway projects. In addition, the random group allocation can also prepare students for real professional work life (Lewis and Geertshuis, 2018).

Based on previous discussion and feedbacks the author received from students (in the form of MEQs, in the form of personal communications, and explicit comments made on peer assessment form), students reported that there is a lack of module coherence and cross transfer of knowledge in railway curriculum (e.g. ‘*I’ve never learnt how to calculate stress, strain or displacements*’, ‘*I don’t know why traction is mentioned here in wheel-rail interface*’). Students tended to have difficulty in learning the Year 2 modules (in Table 2) and they wrongly believed that all modules were very new to them. To enhance the coherence and cross transfer of knowledge among modules, it could also be possible that the railway infrastructure and traction could be linked closely and the class can be later offered at a gradual pace over different stages (as Railway Engineering Module); and this applies similarly to Train Control and Railway Operations, as tabulated in a table below. This change (in Table 4) will allow the students to draw the supporting knowledge from relevant courses in their main discipline (e.g. Statics / Soil Mechanics) and build competency in railway engineering by degree via the coherent modules in the curriculum. On the other hand, each module could also provide another pathway to cross transfer knowledge by joint developing final year projects where knowledge can be drawn up from multi disciplines.

Table 4: Proposed change for BEng/MEng Civil and Railway Engineering at UOB

Theme	Year 1	Year 2		Year 3		Year 4 (MEng)
Railway	- Introduction to Railway Systems	- Railway Engineering I - Train Control and Operations I	Optional Year Placement	- Railway Engineering II - Train Control and Operations II - Design projects	Optional Year Placement	- Advanced topics in railway - Research Projects

In addition, the importance of ‘competency and attitude’ should be considered in the curriculum and module activities (Conner et al., 2000; Burdett and Baker 2017). By engaging students, the author, as an educator, needs to embrace other aspects of academic practice on teaching and learning such as the inclusion of activities and classroom tasks that inspire students and motivate them to have a clear passion for railway diverse careers. Crucially, this intrinsic motivation can break through the difficulties students may experience in the curriculum, personally or systemically.

Conclusion

Railway engineering education has been reviewed and evaluated using student and staff feedbacks and the author’s authentic academic identity and values that promote four legs of scholarly contribution including research, teaching, administration and academic citizenship. These identity legs coexist and inter-relate with value chains in teaching, research, administration and outreach, ultimately resulting in enhanced prestige and reputation of railway engineering education. This study aims to present the importance of interdisciplinary teaching and learning to produce systems-thinking and multi-faceted team approaches to sustainable rail engineering solutions. In this paper, the author has reviewed academic and industrial values that inform curriculum and module review, in compliance with The UK Professional Standards Framework and UK Engineering Council, with respect to teaching and learning effectiveness and the impact of such activities. A wide range of teaching, learning and assessment activities with reference to pedagogic research and scholarship has been discussed. The focus and recommendations of railway engineering curriculum review are associated with activities that enhance employability, systems thinking and educational qualities. The development of class activities and assessments has been examined in order to promote enquiry-based and experiential learning concept. It is important that the flow of integrated technical contents and systems knowledge are grounded to enhance student learning outcomes.

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